sending timing signals to the power modulator, and after predetermined delays, sending timing signals to the synchronous demodulator, wherein the predetermined delays cause the power modulator to operate in zero current switching.

REMARKS - General

The office action asked the applicant to elect a single disclosed species for prosecution on the merits to which the claims shall be restricted, or to traverse on the ground that the species are not patentably distinct. The applicant hereby submits that all species are obvious variations for the skilled in the art, that of class-N amplifiers, as this type of switching amplifiers are called in different publications including the proceedings of SAE 2002 World Congress, because of their merging of a switching power supply and a switching amplifier into irreducible circuits, for the following reasons:

1. All embodiments belong to a same SMPS topology, that of buck-derived converters. In switch-mode power supplies (SMPS), it has been taught that there are only four basic topologies of SMPS: buck, boost, buck-boost, and Cuk converters. All other SMPS, some three hundred of them, are derived from these four basic SMPS topologies, oftentimes by inserting a transformer along the flow of the switching current, and/or by doubling the number of switches by mirror image of a "single-ended" converter. For example, the buck family of SMPS includes the common non-isolated buck converter, the "forward converter" which has a transformer added for electrical isolation between the input and the output, the "push-pull converter" which is essentially two forward converters in mirror image with a center-tapped transformer, the "half-bridge converter" , the "full-bridge converter", etc...They all the same transfer function, that of the buck converter, with a multiplier to account for the turn ratio of the transformer if one is used. By topological manipulation, the skilled in the art of SMPS have been able to generate hundreds more buck-derived SMPS by adding taps to either the transformer and/or the inductor of the buck-derived SMPS mentioned above, or by using the impedance transformation property of a transformer to relocate an impedance on one side of the transformer to the other side of the transformer. The applicant used the same topological transformations to arrive at many different embodiments which have exactly the same transfer function as a buck-derived SMPS when the flow of energy is from the power source to the load, which is normally a loudspeaker but can be any other complex impedance such as a winding of motor. However, amplifiers need to produce a bipolar output voltage, therefore there is always two symmetrical current loops at the output in class-N amplifiers.

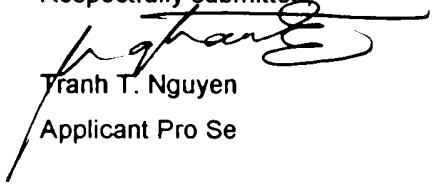
2. The basic novelty in class-N amplifiers is in the synchronous demodulator 16. Prior art such as taught in U.S.Pat. # 4,573,018 by Mirow comprises some same elements (modulator, transformer, current-smoothing filter) but for uses two full-wave rectifiers for demodulation. The

use of a rectifiers in Mirow's demodulator prevents the flow of energy from the output to the input (or power source) essential for driving a complex impedance such as a loudspeaker. The applicant's synchronous demodulators appear to be different in the many embodiments of the specification, but only to accommodate the need to provide bipolar output voltage (or equivalently, bi-directional current flow in the load) while using switches such as MOSFETs that can inherently block the flow of current in only one direction. The adaptation of the configuration of the synchronous demodulator 16 to the configurations of the power modulator 12 may not be obvious to the average electrical engineer but it is obvious to the applicant who is skilled in the art of power conversion and SMPS. The applicant believes that once the concept of synchronous demodulation for re-creation of bipolar output voltage from the transformer T1 voltage(s) is known, other skilled in the art of SMPS such as Drs. F. Lee, R.Middlebrook, S.Cuk will be able to come up with the same configurations, very likely even more configurations than the applicant has presented. The applicant has shown the drawings of the most economical or simplest configurations of the synchronous demodulators 16, and knows that other configurations exists, all based on two buck-derived converters to provide two directions of current flow. Similarly, Dr. Cuk's patented converters - U.S.Pat. # 4,184,197 ; 6,388,896 and 6,400,579 - have many variations and configurations, with or without isolation transformer, with or without coupled inductors. Again, all Cuk's converters have the same transfer function. Thus the applicant's family of synchronous demodulators 16 particular to class-N amplifiers have variations for adaptation to particular power modulators 12 and for cost savings, but all resulting amplifiers are still of the class-N, in the same fashion as there are a few different configurations of class-D amplifiers or buck-derived SMPS.

Attached hereto is a clean set of all pending claims is attached.

Applicant respectfully requests that a timely Notice of Allowance be issued in this case.

Respectfully submitted,



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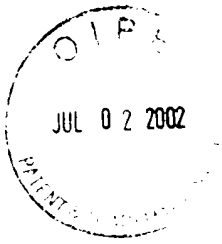

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